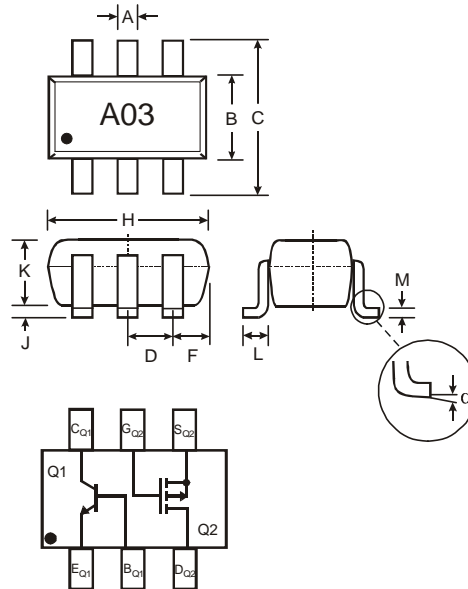


**Features**

- Combines MMBT4401 type transistor with BSS84 type MOSFET
- Small Surface Mount Package
- PNP/N-Channel Complement Available: CTA2P1N
- **Lead Free/RoHS Compliant (Note 2)**
- **"Green" Device (Note 3 and 4)**

**Mechanical Data**

- Case: SOT-363
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020C
- Terminals: Solderable per MIL-STD-202, Method 208
- Lead Free Plating (Matte Tin Finish annealed over Alloy 42 leadframe).
- Terminal Connections: See Diagram
- Marking Information: A03, See Page 6
- Ordering Information: See Page 6
- Weight: 0.006 grams (approximate)



| SOT-363              |              |      |
|----------------------|--------------|------|
| Dim                  | Min          | Max  |
| A                    | 0.10         | 0.30 |
| B                    | 1.15         | 1.35 |
| C                    | 2.00         | 2.20 |
| D                    | 0.65 Nominal |      |
| F                    | 0.30         | 0.40 |
| H                    | 1.80         | 2.20 |
| J                    | —            | 0.10 |
| K                    | 0.90         | 1.00 |
| L                    | 0.25         | 0.40 |
| M                    | 0.10         | 0.25 |
| $\alpha$             | 0°           | 8°   |
| All Dimensions in mm |              |      |

**Maximum Ratings, Total Device** @T<sub>A</sub> = 25°C unless otherwise specified

| Characteristic                                   | Symbol                            | Value       | Unit |
|--------------------------------------------------|-----------------------------------|-------------|------|
| Power Dissipation (Note 1)                       | P <sub>d</sub>                    | 150         | mW   |
| Thermal Resistance, Junction to Ambient (Note 1) | R <sub>θJA</sub>                  | 833         | °C/W |
| Operating and Storage Temperature Range          | T <sub>j</sub> , T <sub>STG</sub> | -55 to +150 | °C   |

**Maximum Ratings, Q1, MMBT4401 NPN Transistor Element** @T<sub>A</sub> = 25°C unless otherwise specified

| Characteristic                 | Symbol           | Value | Unit |
|--------------------------------|------------------|-------|------|
| Collector-Base Voltage         | V <sub>CB0</sub> | 60    | V    |
| Collector-Emitter Voltage      | V <sub>CE0</sub> | 40    | V    |
| Emitter-Base Voltage           | V <sub>EBO</sub> | 6.0   | V    |
| Collector Current - Continuous | I <sub>c</sub>   | 600   | mA   |

**Maximum Ratings, Q2, BSS84 P-Channel MOSFET Element** @T<sub>A</sub> = 25°C unless otherwise specified

| Characteristic                             | Symbol           | Value | Unit |
|--------------------------------------------|------------------|-------|------|
| Drain-Source Voltage                       | V <sub>DSS</sub> | -50   | V    |
| Drain-Gate Voltage R <sub>GS</sub> ≤ 1.0MΩ | V <sub>DGR</sub> | -50   | V    |
| Gate-Source Voltage Continuous             | V <sub>GSS</sub> | ±20   | V    |
| Drain Current Continuous                   | I <sub>D</sub>   | -130  | mA   |

- Notes:
1. Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch; pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.
  2. No purposefully added lead.
  3. Diodes Inc.'s "Green" policy can be found on our website at [http://www.diodes.com/products/lead\\_free/index.php](http://www.diodes.com/products/lead_free/index.php).
  4. Product manufactured with Date Code UO (week 40, 2007) and newer are built with Green Molding Compound. Product manufactured prior to Date Code UO are built with Non-Green Molding Compound and may contain Halogens or Sb2O3 Fire Retardants.

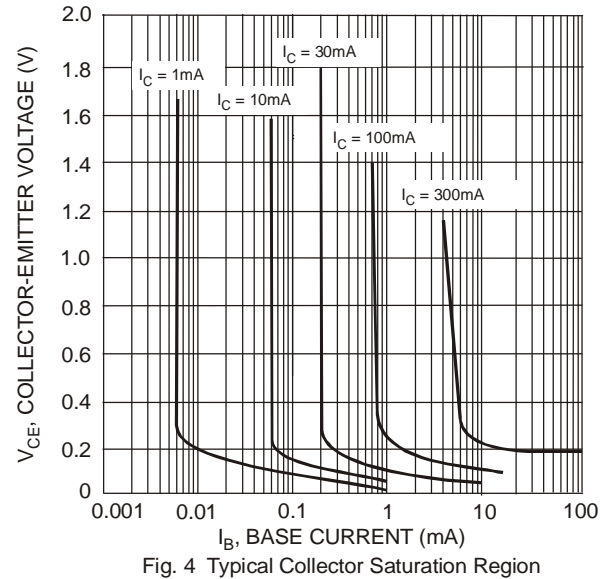
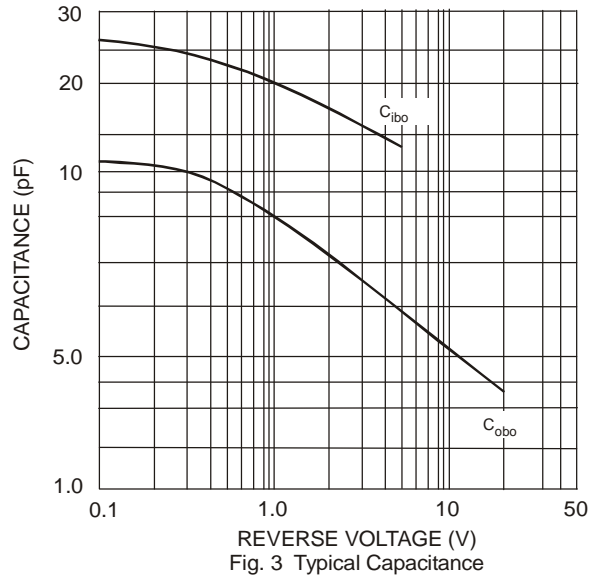
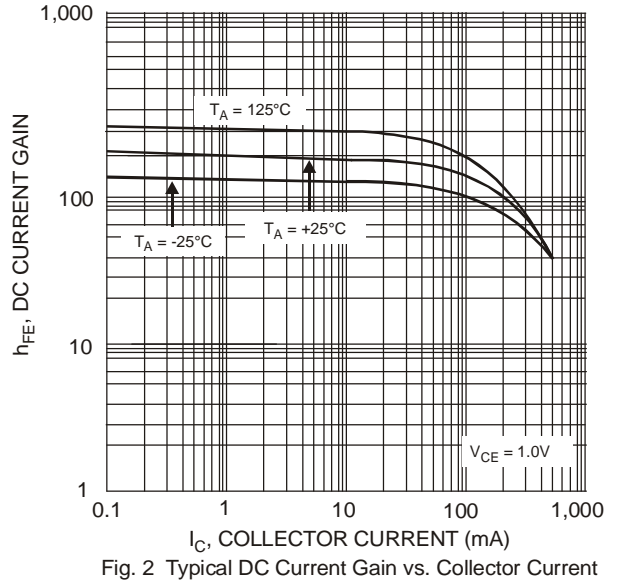
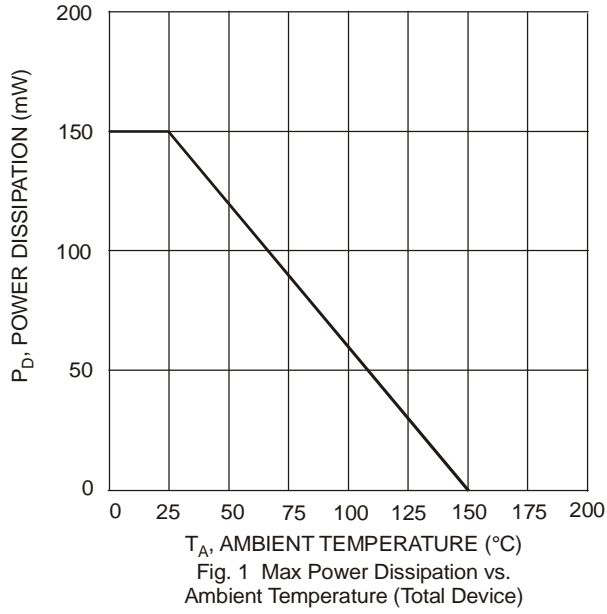
**Electrical Characteristics, Q1, MMBT4401 NPN Transistor Element** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

| Characteristic                       | Symbol        | Min       | Max          | Unit             | Test Condition                                                                                                                                                                                                                      |
|--------------------------------------|---------------|-----------|--------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>OFF CHARACTERISTICS (Note 5)</b>  |               |           |              |                  |                                                                                                                                                                                                                                     |
| Collector-Base Breakdown Voltage     | $V_{(BR)CBO}$ | 60        | —            | V                | $I_C = 100\mu\text{A}, I_E = 0$                                                                                                                                                                                                     |
| Collector-Emitter Breakdown Voltage  | $V_{(BR)CEO}$ | 40        | —            | V                | $I_C = 1.0\text{mA}, I_B = 0$                                                                                                                                                                                                       |
| Emitter-Base Breakdown Voltage       | $V_{(BR)EBO}$ | 6.0       | —            | V                | $I_E = 100\mu\text{A}, I_C = 0$                                                                                                                                                                                                     |
| Collector Cutoff Current             | $I_{CEX}$     | —         | 100          | nA               | $V_{CE} = 35\text{V}, V_{EB(OFF)} = 0.4\text{V}$                                                                                                                                                                                    |
| Base Cutoff Current                  | $I_{BL}$      | —         | 100          | nA               | $V_{CE} = 35\text{V}, V_{EB(OFF)} = 0.4\text{V}$                                                                                                                                                                                    |
| <b>ON CHARACTERISTICS (Note 5)</b>   |               |           |              |                  |                                                                                                                                                                                                                                     |
| DC Current Gain                      | $h_{FE}$      | 20        | —            | —                | $I_C = 100\mu\text{A}, V_{CE} = 1.0\text{V}$<br>$I_C = 1.0\text{mA}, V_{CE} = 1.0\text{V}$<br>$I_C = 10\text{mA}, V_{CE} = 1.0\text{V}$<br>$I_C = 150\text{mA}, V_{CE} = 1.0\text{V}$<br>$I_C = 500\text{mA}, V_{CE} = 2.0\text{V}$ |
|                                      |               | 40        | —            |                  |                                                                                                                                                                                                                                     |
|                                      |               | 80        | —            |                  |                                                                                                                                                                                                                                     |
|                                      |               | 100       | 300          |                  |                                                                                                                                                                                                                                     |
|                                      |               | 40        | —            |                  |                                                                                                                                                                                                                                     |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$ | —         | 0.40<br>0.75 | V                | $I_C = 150\text{mA}, I_B = 15\text{mA}$<br>$I_C = 500\text{mA}, I_B = 50\text{mA}$                                                                                                                                                  |
| Base-Emitter Saturation Voltage      | $V_{BE(SAT)}$ | 0.75<br>— | 0.95<br>1.2  | V                | $I_C = 150\text{mA}, I_B = 15\text{mA}$<br>$I_C = 500\text{mA}, I_B = 50\text{mA}$                                                                                                                                                  |
| <b>SMALL SIGNAL CHARACTERISTICS</b>  |               |           |              |                  |                                                                                                                                                                                                                                     |
| Output Capacitance                   | $C_{cb}$      | —         | 6.5          | pF               | $V_{CB} = 5.0\text{V}, f = 1.0\text{MHz}, I_E = 0$                                                                                                                                                                                  |
| Input Capacitance                    | $C_{eb}$      | —         | 30           | pF               | $V_{EB} = 0.5\text{V}, f = 1.0\text{MHz}, I_C = 0$                                                                                                                                                                                  |
| Input Impedance                      | $h_{ie}$      | 1.0       | 15           | k $\Omega$       | $V_{CE} = 10\text{V}, I_C = 1.0\text{mA},$<br>$f = 1.0\text{kHz}$                                                                                                                                                                   |
| Voltage Feedback Ratio               | $h_{re}$      | 0.1       | 8.0          | $\times 10^{-4}$ |                                                                                                                                                                                                                                     |
| Small Signal Current Gain            | $h_{fe}$      | 40        | 500          | —                |                                                                                                                                                                                                                                     |
| Output Admittance                    | $h_{oe}$      | 1.0       | 30           | $\mu\text{S}$    |                                                                                                                                                                                                                                     |
| Current Gain-Bandwidth Product       | $f_T$         | 250       | —            | MHz              |                                                                                                                                                                                                                                     |
| <b>SWITCHING CHARACTERISTICS</b>     |               |           |              |                  |                                                                                                                                                                                                                                     |
| Delay Time                           | $t_d$         | —         | 15           | ns               | $V_{CC} = 30\text{V}, I_C = 150\text{mA},$<br>$V_{BE(off)} = 2.0\text{V}, I_{B1} = 15\text{mA}$                                                                                                                                     |
| Rise Time                            | $t_r$         | —         | 20           | ns               |                                                                                                                                                                                                                                     |
| Storage Time                         | $t_s$         | —         | 225          | ns               | $V_{CC} = 30\text{V}, I_C = 150\text{mA},$<br>$I_{B1} = I_{B2} = 15\text{mA}$                                                                                                                                                       |
| Fall Time                            | $t_f$         | —         | 30           | ns               |                                                                                                                                                                                                                                     |

**Electrical Characteristics, Q2, BSS84 P-Channel MOSFET Element** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

| Characteristic                      | Symbol       | Min  | Typ | Max      | Unit          | Test Condition                                                                             |
|-------------------------------------|--------------|------|-----|----------|---------------|--------------------------------------------------------------------------------------------|
| <b>OFF CHARACTERISTICS (Note 5)</b> |              |      |     |          |               |                                                                                            |
| Drain-Source Breakdown Voltage      | $BV_{DSS}$   | -50  | —   | —        | V             | $V_{GS} = 0\text{V}, I_D = -250\mu\text{A}$                                                |
| Zero Gate Voltage Drain Current     | $I_{DSS}$    | —    | —   | -15      | $\mu\text{A}$ | $V_{DS} = -50\text{V}, V_{GS} = 0\text{V}, T_J = 25^\circ\text{C}$                         |
|                                     |              | —    | —   | -60      | $\mu\text{A}$ | $V_{DS} = -50\text{V}, V_{GS} = 0\text{V}, T_J = 125^\circ\text{C}$                        |
|                                     |              | —    | —   | -100     | nA            | $V_{DS} = -25\text{V}, V_{GS} = 0\text{V}, T_J = 25^\circ\text{C}$                         |
| Gate-Body Leakage                   | $I_{GSS}$    | —    | —   | $\pm 10$ | nA            | $V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$                                              |
| <b>ON CHARACTERISTICS (Note 5)</b>  |              |      |     |          |               |                                                                                            |
| Gate Threshold Voltage              | $V_{GS(th)}$ | -0.8 | —   | -2.0     | V             | $V_{DS} = V_{GS}, I_D = -1\text{mA}$                                                       |
| Static Drain-Source On-Resistance   | $R_{DS(ON)}$ | —    | —   | 10       | $\Omega$      | $V_{GS} = -5\text{V}, I_D = 0.100\text{A}$                                                 |
| Forward Transconductance            | $g_{FS}$     | .05  | —   | —        | S             | $V_{DS} = -25\text{V}, I_D = 0.1\text{A}$                                                  |
| <b>DYNAMIC CHARACTERISTICS</b>      |              |      |     |          |               |                                                                                            |
| Input Capacitance                   | $C_{iss}$    | —    | —   | 45       | pF            | $V_{DS} = -25\text{V}, V_{GS} = 0\text{V}$<br>$f = 1.0\text{MHz}$                          |
| Output Capacitance                  | $C_{oss}$    | —    | —   | 25       | pF            |                                                                                            |
| Reverse Transfer Capacitance        | $C_{rss}$    | —    | —   | 12       | pF            |                                                                                            |
| <b>SWITCHING CHARACTERISTICS</b>    |              |      |     |          |               |                                                                                            |
| Turn-On Delay Time                  | $t_{D(ON)}$  | —    | 10  | —        | ns            | $V_{DD} = -30\text{V}, I_D = -0.27\text{A},$<br>$R_{GEN} = 50\Omega, V_{GS} = -10\text{V}$ |
| Turn-Off Delay Time                 | $t_{D(OFF)}$ | —    | 18  | —        | ns            |                                                                                            |

Notes: 5. Short duration pulse test used to minimize self-heating effect.



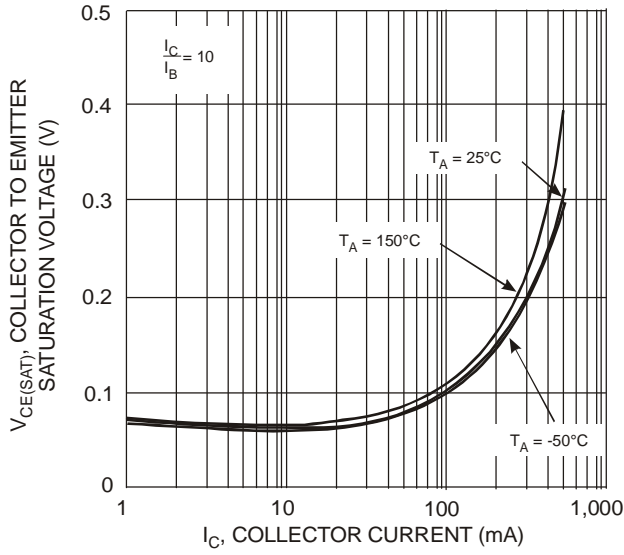


Fig. 5 Collector Emitter Saturation Voltage vs. Collector Current

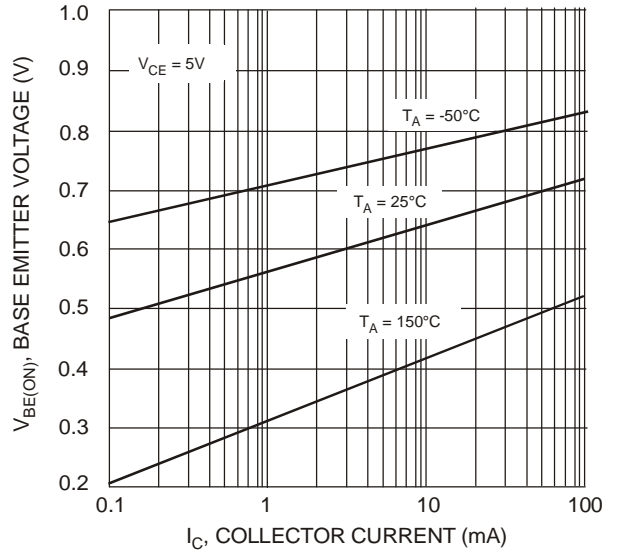


Fig. 6 Base Emitter Voltage vs. Collector Current

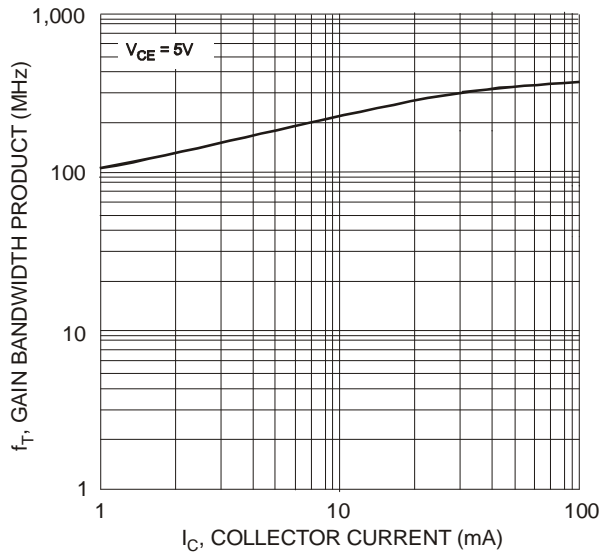


Fig. 7 Gain Bandwidth Product vs. Collector Current

NEW PRODUCT

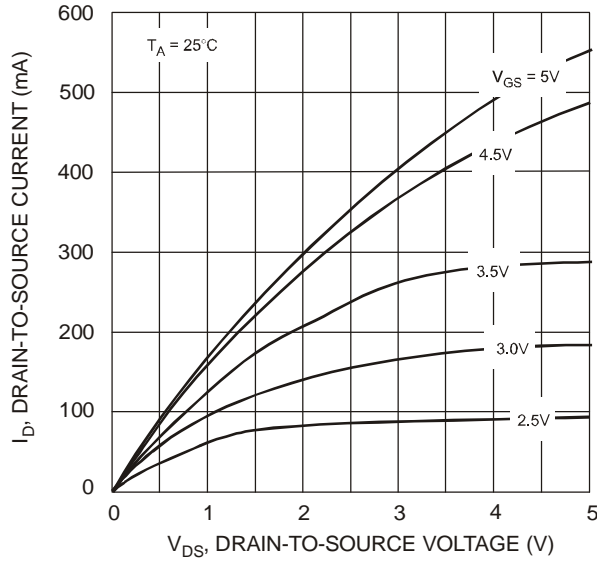


Fig. 8 Drain-Source Current vs. Drain-Source Voltage

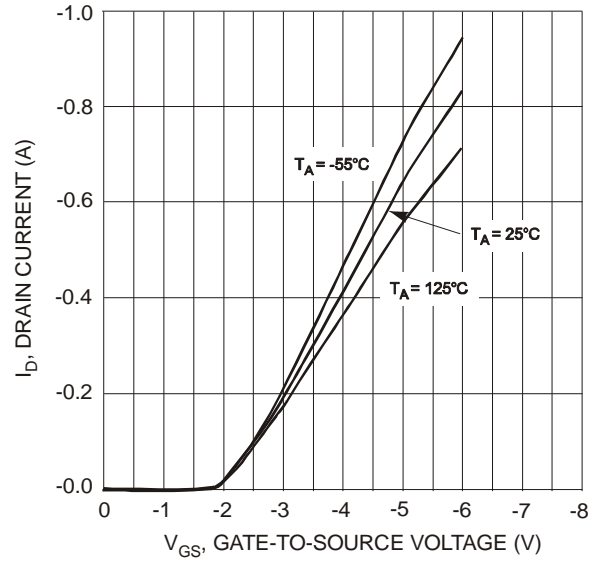


Fig. 9 Drain Current vs. Gate Source Voltage

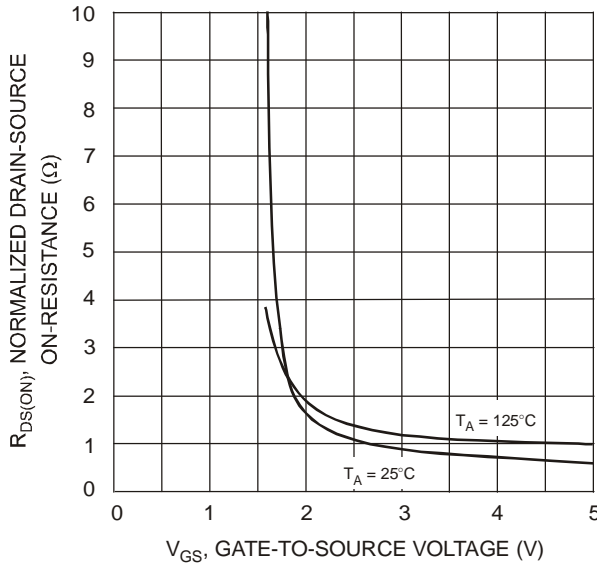


Fig. 10 On-Resistance vs. Gate-Source Voltage

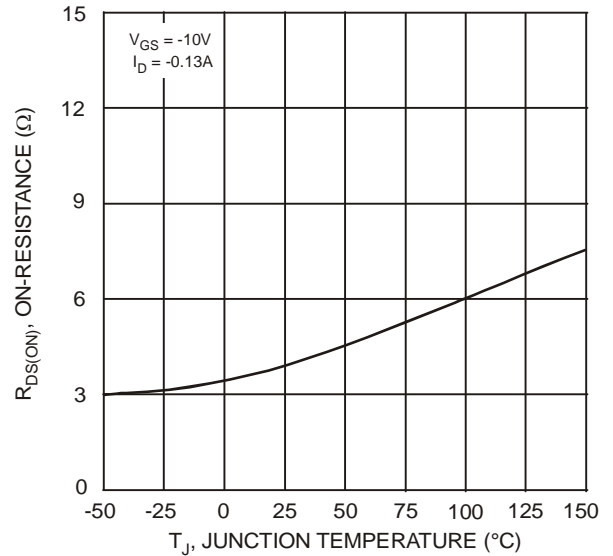


Fig. 11 On-Resistance vs. Junction Temperature

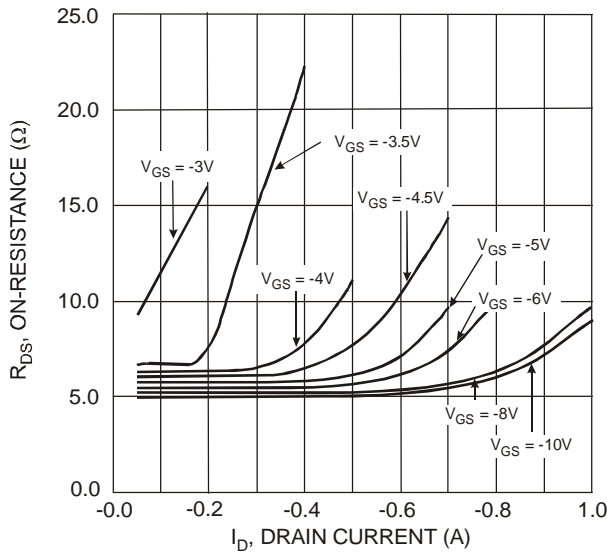


Fig. 12, On-Resistance vs. Drain Current

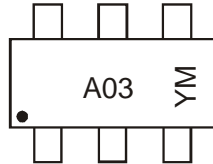
NEW PRODUCT

## Ordering Information (Note 6)

| Device      | Packaging | Shipping         |
|-------------|-----------|------------------|
| CTA2N1P-7-F | SOT-363   | 3000/Tape & Reel |

Notes: 6. For packaging details, go to our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

## Marking Information



A03 = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year ex: T = 2006  
 M = Month ex: 9 = September

### Date Code Key

| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Code | M    | N    | P    | R    | S    | T    | U    | V    | W    | X    | Y    | Z    |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Code  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | O   | N   | D   |

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